Quantum Environmental & Engineering Services, LLC

09.009

LWL 12/5/11 REV
12/8/11 Resp LTR

October 31, 2011

File
Monitoring report

Mr. Mark Carnes
U.S. Army Corps of Engineers
Regulatory Branch
3701 Bell Road
Nashville, TN 37214-2660

Subject: First Year Wetland and Stream Monitoring Report, Bledsoe County Correctional Complex, Pikeville, TN

Dear Mr. Carnes:

Enclosed for your review is a hard copy and electronic copy of the first annual wetland and stream monitoring report for the Bledsoe County Correctional Complex (BCCX) located in Pikeville, Tennessee (DOA File/Permit Number 200502425, TDEC §401 Water Quality Certification Number NRS 09.009). This document has been compiled to fulfill the requirements of the above cited permits. The report generally follows the format provided in the Corps' October 2008 Regulatory Guidance Letter 08-03, but, owing to the complexity of the project, we have exceeded the recommended page limits in a number of sections. We have also included in the report information specifically requested by TDEC's Division of Water Pollution Control. This was done to avoid the need of producing separately tailored reports for each reviewing agency.

If you have any questions about this submission please call me at (865) 689-1395. I will be glad to give you a tour of the site any time you are in the vicinity.

Sincerely,

Helen S. Hennon

Helen S. Hennon, P.E.
Vice President of Environmental Services

Enclosures (2)

c: M. Lee, TDEC-Nashville
J. Innes, TDEC-Chattanooga
G. Steck, TDFA
T. Robinson, TDOC
B. Westbrooks, TDOC
S. Westerman, TDOC
P. Durr, Water Resources, LLC
QE^2 Project File – BC.142.013.09

126 Dante Road Knoxville, Tennessee 37918 phone: 865.689.1395 fax: 865.689.6844 www.QE2LLC.com

First Year Wetland and Stream Mitigation Monitoring Report
Bledsoe County Correctional Complex
Pikeville, Bledsoe County, Tennessee
(DOA File/Permit 200502425)
(TDEC §401 Water Quality Certification 09.009)

October 31, 2011

Submitted To:

U.S. Army Corps of Engineers, Nashville District
&
Tennessee Department of Environment and Conservation

Prepared By:

Water Resources, LLC
4208 Eiffel Lane
Knoxville, TN 37938-2943

Under Subcontract to:

Quantum Environmental & Engineering Services, LLC
126 Dante Road
Knoxville, TN 37918

Section 1

Project Overview

Mitigation Site Name: Bledsoe County Correctional Complex (BCCX), Pikeville, TN

DOA Permit Number: 200502425

TDEC Permit Number: NRS 09.009

Party Responsible for Monitoring: Paul C. Durr/Water Resources, LLC under subcontract to Quantum Environmental and Engineering Services, LLC

Monitoring Dates: September 26-30, 2011 (First Year Monitoring)

Project Description: In February 2010 the Tennessee Department of Environment and Conservation (TDEC) granted the Tennessee Department of Finance and Administration a §401 Water Quality Certification to allow the filling of 1.96 acres of jurisdictional wetlands and alteration of 560 linear ft of streams and 715 ft of wet weather conveyances. Impacts to these aquatic resources were determined to be necessary to facilitate the development of a major prison expansion project. In June 2010 U.S. Army Corps of Engineers-Nashville District (USACE) granted a §404 permit for the same project. After minor modification, the final TDEC permit was reissued in December of that year.

Mitigation for the wetland and stream impacts was initiated in early October 2010. Wetland mitigation occurred entirely onsite and involved the creation (establishment) of 4.18 acres of palustrine wetlands (4:1 ratio) and the enhancement of 6.12 acres of existing degraded wetlands (5:1 ratio). The entire wetland mitigation site was then planted with water-tolerant tree species which are indigenous to the local watershed. Planting was done at an approximate rate of 435 stems/acre. Stream mitigation was also undertaken onsite. It involved Level 1 enhancement of 2,660 ft of intermittent headwater tributaries to Bee Creek. Riparian zones of four tributary segments were planted with native shrubs. Twenty-five foot-wide upland buffers lying on either side of the streams and wetlands were also planted. Additional details can be found in the document titled: *Aquatic Resources Mitigation Plan, Bledsoe County Correctional Complex Bee Creek Mile 11.4, Right Bank, Pikeville, Tennessee* drafted by Water Resources, LLC.

Project Location: The mitigation site is centered approximately 1,100 ft north-northeast of the intersection of SR 285 and SR 301 in rural Bledsoe County, Tennessee (N35.7508, W85.2359). (See Section 4 for a general location map).

Dates When the Mitigation Project Began and Was Completed: Mitigation construction began in September, 2010 and was completed in October, 2011. Wetland and riparian buffer vegetation planting was completed on December 11, 2010.

Performance Standards: **Established Wetlands** - The site's performance standards for hydrology have been met, but have not been met for planted wetland vegetation and soils. **Enhanced Wetlands** - Performance standards have been met for hydrology and soils, but not for planted vegetation. **Streams** - Performance standards for channel integrity within all stream restoration areas have been met but have not been met with respect to planted woody vegetation. Because it was often not possible to distinguish planted individuals from naturally occurring ones, it was especially difficult to assess performance standards in terms of stem density or survival. Failures, however, consistently occurred as a result of skewed species distributions (i.e., in all cases one of the planted species far exceeded the allowable 20% of the population). **Other** - Signs designating the area as a protected wetland, have not yet been installed. This will occur when funding becomes available. The Declaration of Restriction for protecting the mitigation site in perpetuity has been prepared, and is ready to be processed. The year 2 monitoring report will contain an update of these items.

Dates of Corrective Actions or Maintenance: Particularly intense rainfall events in November 2010 and March 2011 caused flooding and attending erosion within the wetland creation area. In April 2011 efforts were made to lessen further damage by controlling the rate of inflow to the site by re-contouring the splitter pond, reinforcing and reconstructing spreader berms, and placing coir log erosion barriers in areas shown to be especially prone to erosion.

Recommendations for Additional Corrective Actions: First year monitoring revealed that planted tree and shrub survival has been poor, especially in wetland mitigation areas. In the creation area, high mortality appears to be directly related to several flood events that occurred in late fall and winter. This was followed by exceptionally dry weather in August. Within wetland enhancement and stream mitigation zones, mortality seems to be more a function of dense competition from native wetland grasses and sedges, particularly redtop panic grass. Recommended future corrective actions should involve replanting all wetland mitigation areas so that seedling densities reach the required minimum of 435 trees/acre as stipulated in the USACE and TDEC permits. If conditions allow, consideration should be given to judicious mowing of areas dominated by redtop panic grass prior to planting. Replanting of selected portions of stream mitigation areas should also be undertaken. For best success, plantings should occur no later than December 1, 2011 to avoid frozen soils.

Wetlands

Performance Standards	Year 1 Monitoring & Monitoring Conditions		Performance Standards Met?		Data References (see Sections 3 & 4)
Onsite mitigation will involve the creation of 4.18 acres of wetlands and the enhancement of 6.12 acres of wetlands in the headwaters of Bee Creek. Bare root seedlings will be planted at the rate of 435 stems/ac. No one species shall comprise more than 20% of the total. The entire wetland mitigation is to be protected in perpetuity through deed restriction and signage erected to indicate the protected status of the property. The specific performance standards associated with the mitigation action are summarized below.	Vegetation demographics were determined from 0.05-acre fixed area sample plots (for woody species) and 1-yd^2 plots (for herbs). Sampling methods are described in the site's final Aquatic Resource Mitigation Plan. Because native hydric soils were not known within the creation area prior to mitigative actions, soil profiles will be taken annually at each of the vegetation monitoring plots in order to document the transition to the hydric condition. The principal means used to judge the successful restoration of positive wetland hydrology will be the establishment of wetland vegetation. Other primary and secondary hydrologic indicators will be noted during monitoring.				
Creation Area: Success will be measured as a function of wetland plant dominance and the presence of positive wetland hydrology. At the end of five years, approximately 70% of herbaceous plant cover must be comprised of wetland-adapted species and survival rates for planted woody species must be at least 75% (326 stems/ac). Areal coverage of exotic invasive species must be less than 5%. While the development of hydric soils is a desired goal, it is understood that hydric soil formation may take greater than 5 years to occur.	Vegetation:	Total herbaceous plant cover is **43.75%**. **66.67%** of the cover is comprised of wetland-adapted species. If just the most-dominant species are considered, then 50.00% are wetland- adapted. The relatively low amount of cover is directly related to well above average precipitation which caused extensive ponding and scouring throughout the creation site, especially in late fall and winter. Current density of planted woody species is **65 stems/ac**. 50% of species are wetland-adapted. This represents a 14.94% survival rate for year one (planting rate for all species, was 435 stems/ac). No naturally invading seedlings were identified.	Vegetation:	No	Section 3: Table 1 Table 3 Section 3: Photos 1-8 Section 4: Maps 1 & 2
	Soils:	Soils in the creation area have been mapped by the Natural Resources Conservation Service as containing Lily loam and Morehead-Bonair complex. The latter contains inclusions of hydric Bonair soils in low-lying areas and depressions. Indeed, residual hydric soils were confirmed, but in only 50% of the samples.	Soils:	No	Section 3: Table 6

Performance Standards	Year 1 Monitoring & Monitoring Conditions		Performance Standards Met?		Data References (see Sections 3 & 4)
	Hydrology:	Although a dominance of wetland vegetation has not yet become established, a variety of primary and secondary hydrologic indicators are present in the creation area. These include scattered surface inundation, soil saturation within the upper 12 in., drift deposits, surface soil cracks, and drainage patterns.	Hydrology:	Yes	
Enhancement Area: The same performance standards described above for the creation area shall also apply for the enhancement area. However, because the enhancement area is already a jurisdictional wetland and contains hydric soils, it will not be monitored for that parameter.	Vegetation:	Herbaceous plant cover is **95.58%**. This is distributed among 30 distinct taxa. **93.99%** of the cover is comprised of wetland-adapted species. If just the most-dominant species are considered (based on sampling frequency and cover), then 100% are wetland adapted. Current combined density of planted and naturally-invasive woody species is **153.33** stems/ac. Of the 8 taxa identified, 5, or **62.5%** are wetland-adapted. All tree seedlings appear to have been planted. The two shrub species found, however, are naturally invasive. Sample estimates indicate that these occur at a rate of **86.33** stems/ac and constitute just over 56% of the total stocking density.	Vegetation:	No	Section 3: Table 2 Table 4 Section 3: Photos 9-20 Section 4: Maps 1 & 2
	Soils:	Morehead-Bonair complex. This series is recognized as containing inclusions of hydric Bonair soils in low areas and depressions. Hydric soils were confirmed by the USACE during a jurisdictional determination visit to the site in November 2008.	Soils:	Yes	
	Hydrology:	Several hydrologic indicators were observed during the monitoring survey. These include soil saturation, sediment deposits, drift deposits, drainage patterns, crayfish burrows, and geomorphic position.	Hydrology:	Yes	

Performance Standards	Year 1 Monitoring & Monitoring Conditions		Performance Standards Met?		Data References (see Sections 3 & 4)
Upland Buffer Area: 25 ft-wide buffers, external to riparian buffers (see next page) are to be planted with upland oak species in order to provide extra protection to the restored streams. Initial planting is to be at 435 stems/ac but no performance standards for seedling survival are stipulated.	Vegetation: Soils: Hydrology:	Density of planted oak species within the buffer zones is **200 stems/ac**. Only two species were confirmed, white oak and northern red oak. Naturally-invading black cherry contributed the equivalent of another **5 stems/ac**.	Vegetation: Soils: Hydrology:	Not Applicable Not Applicable Not Applicable	Section 3: Table 5 Section 3: Photo 21 Section 4: Maps 1 & 2
Gooseberry Transplant Area: Multi-stemmed granite gooseberry shrubs are to be removed from the prison expansion footprint and transplanted to an upland area on the stream and wetland mitigation property. This effort will be undertaken in an attempt to preserve this exceptionally rare shrub. No performance standards for shrub survival are stipulated. (This action was completed in March 2009.)	Vegetation: Soils: Hydrology:	Because of its highly colonial nature it was not possible to make an accurate count of individual stems. Instead, an estimate of the plants' areal coverage was obtained by measuring the major and minor axes of all shrubs that could be located within the transplant area. In all, **19 shrubs covering a total of 1,990 ft^2** were tallied.	Vegetation: Soils: Hydrology:	Not Applicable Not Applicable Not Applicable	Section 3: Photos 22

Streams

Performance Standards	Year 1 Monitoring & Monitoring Conditions		Performance Standards Met?		Data References (see Sections 3 & 4)
Stream mitigation will involve the enhancement of 2,660 ft of headwater tributaries to Bee Creek. Four individual segments are to be treated. Riparian shrub vegetation shall be planted 25-ft along both banks. Plantings shall be at least three rows deep along each channel staggered on 10-ft centers. Bare root or containerized stock is permissible. No one species can comprise more than 20% of the total. Stream mitigation areas are to be protected in perpetuity through deed restriction and signage erected to indicate the protected status of the properties. The performance standards for the mitigation actions are described briefly below.	Pre-construction stream habitat conditions were documented in 2008 using EPA/TDEC habitat assessment methodologies (see Appendix A). Post-construction conditions were determined by employing Level I protocols set forth by TDEC in the *Stream Mitigation Guidelines for the State of* Tennessee (TDEC 2004). Riparian zone vegetation surveys made use of staggered 200 x 25 ft fixed area sample plots spaced 200 ft apart on each of the stream segments in order to determine survivorship of planted material and establishment of naturally invading woody species.				
Enhancement of Unnamed Tributary to Bee Creek Stream Segment 1 (1,793 ft): Success will be determined by the establishment of a waterway that is stable, has a discernible bed and bank, and has typical in-stream habitat. The banks must be stable and non-eroding with adequate vegetative cover to prevent eroding sediments from entering the stream. This includes a 75% survival rate for planted trees and shrubs for five consecutive years (45 stems/100 ft of stream channel).	Channel Conditions:	Because the stream segment lies entirely within a wetland enhancement area that required no earthmoving, the original stability of the waterway has remained intact. The primary waterway contains well-defined bed and bank. While some limited portions of the reach have eroded down to bedrock, most areas are silt and mud-dominated. Relatively flat terrain has given rise to a stream that contains only scattered riffle-run sequences. Stream depths at the time of the survey ranged from about 2 in. in upstream areas to over 3 ft in several pools near the middle and downstream end. Aquatic organisms observed in or around the channel include fish (undetermined species), green frogs, narrow-mouth toads, and caddisfly larvae.	Channel:	Yes	Section 3: Table 7 Section 3: Photos 23-27 Section 4: Maps 1 & 2
	Vegetation:	Combined density of planted and naturally-occurring woody species within riparian zones is **95 stems per 100 ft of stream bank length. Planted densities alone average 51 stems per 100 ft.** Given that it was often not possible to discern planted individuals from native ones, it was not possible to determine survivorship levels.	Vegetation:	No	

Performance Standards	Year 1 Monitoring & Monitoring Conditions		Performance Standards Met?		Data References (see Sections 3 & 4)
		Even though riparian shrub counts, irrespective of their source, exceed the performance standard goal of 45 stems/100 ft, the standard has not been met for year 1 since, by themselves, stream alders constitute nearly 62% of the planted stocking density (no one species can exceed 20%).			
Enhancement of Unnamed Tributary to Bee Creek Stream Segment 2 (224 ft): The same performance standards described above for Stream Segment 1 shall apply to this unnamed tributary.	Channel Conditions:	Stream Segment 2 was not impacted by wetland creation efforts so its channel and riparian zones are stable. Bed and banks are well-defined. Riffles and runs are very widely scattered because of low gradients and flow regimes. Fish were observed in a pool located just to the east of SR 301.	Channel:	Yes	Section 3: Table 7 Section 3: Photo 28 Section 4: Maps 1 & 2
	Vegetation:	Combined density of planted and naturally-occurring woody species within riparian zones is **135 stems per 100 ft of stream bank length. Planted densities alone average 98 stems per 100 ft.** Again, even though riparian shrub counts, from various sources, exceed the performance standard of 45 stems/100 ft, the standard has not been met for year 1 since, by themselves, silky dogwoods constitute nearly 97% of the planted stocking density.	Vegetation:	No	
Enhancement of Unnamed Tributary to Bee Creek Stream Segment 3 (388 ft): The same performance standards described above for Stream Segment 1 shall apply to this unnamed tributary.	Channel Conditions:	See comments for Stream Segment 2 above.	Channel:	Yes	Section 3: Table 7 Section 3: Photo 29 Section 4: Maps 1 & 2
	Vegetation:	Density of planted woody species is **16 stems per 100 ft of stream bank length.** No naturally invading trees or shrubs were noted. By all measures, performance standards were not achieved.	Vegetation:	No	
Enhancement of Unnamed Tributary to Bee Creek Segment 4 (255 ft): The same performance standards described above for Segment 1 shall apply to this unnamed tributary.	Channel Conditions:	See comments for Segment 2 above. Flow regimes and riffle/run complexes could not be judged since water was restricted to scattered pools in the downstream section of the reach.	Channel:	Yes	Section 3: Table 7 Section 3: Photo 30 Section 4: Maps 1 & 2

Performance Standards	Year 1 Monitoring & Monitoring Conditions		Performance Standards Met?		Data References (see Sections 3 & 4)
	Vegetation:	Combined density of planted and naturally-occurring woody species within riparian zones is **76 stems per 100 ft of stream bank length. Planted densities alone average 41 stems per 100 ft.** Again, even though riparian shrub counts, from various sources, exceed the performance standard of 45 stems/100 ft, the standard has not been met for year 1 since, by themselves, elderberries constitute 80% of the planted stocking density.	Vegetation:	No	

Section 3

Summary Data
Tables & Photographs

Table 1. Substrate/Herbaceous Species Frequency and Average Cover Percent, BCCX Wetland Creation Area, Pikeville, TN, September 2011.

Substrate/Herbs	Wetland Indicator Status	Percent Frequency	Average Percent Cover
Bare Soil	---	**100.00**	**41.63**
Twig/Leaf Litter [1]	---	**100.00**	**14.63**
three-seeded mercury (*Acalypha rhomboidea*)	Fac-	87.50	2.38
common ragweed (*Ambrosia artemisiifolia*)	**Facu**	**87.50**	**13.75**
broomsedge (*Andropogon virginicus*)	Fac-	37.50	0.75
horseweed (*Conyza canadensis*)	Facu	12.50	0.25
straw-color flatsedge (*Cyperus strigosus*)	Facw+	12.50	0.25
tapered rosette grass (*Dichanthelium acuminatum*)	Fac	37.50	0.75
panic grass (*Dichanthelium* sp.)	--	12.50	0.13
smooth crab grass (*Digitaria ischaemum*)	Upl	25.00	0.63
Virginia buttonweed (*Diodia virginiana*)	Facw	37.50	1.13
barnyard grass (*Echinochloa crus-galli*)	Facw-	25.00	0.38
creeping eryngo (*Eryngium prostratum*)	Facw	25.00	0.38
late-flowering thoroughwort (*Eupatorium serotinum*)	Fac	25.00	0.50
slender fimbry (*Fimbristylis autumnalis*)	Obl	12.50	0.25
orangegrass (*Hypericum gentianoides*)	Facu	12.50	0.25
dwarf St. John's-wort (*Hypericum mutilum*)	Facw	12.50	0.38
taper-tip rush (*Juncus acuminatus*)	Obl	12.50	0.25

[1] Bolded entries indicate dominant species or substrates (i.e. cover contributions exceed 2% and frequency values are greater than 10%).

Table 1 (continued)

Substrate/Herbs	Wetland Indicator Status	Percent Frequency	Average Percent Cover
greater poverty rush [2] (*Juncus anthelatus*)	Fac?	12.50	0.63
grass-leaved rush (*Juncus marginatus*)	Facw	12.50	0.88
Japanese clover (*Kummerowia striata*)	Facu	50.00	0.88
sweetgum (*Liquidambar styraciflua*)	Fac+	12.50	0.25
Indian-tobacco (*Lobelia inflata*)	Fac	12.50	0.25
common evening primrose (*Oenothera biennis*)	Facu	12.50	0.38
slender yellow woodsorrel (*Oxalis dillenii*)	Facu	50.00	0.75
smooth paspalum (*Paspalum laeve*)	**Facw-**	**87.50**	**7.13**
English plantain *(Plantago lanceolata)*	Fac	25.00	0.63
Pennsylvania smartweed (*Polygonum pensylvanicum*)	Facw	25.00	0.50
punctate smartweed (*Polygonum punctatum*)	Facw+	37.50	1.13
common cinquefoil (*Potentilla simplex*)	Facu	12.50	0.13
yellow foxtail grass (*Setaria pumila*)	**Fac**	**62.50**	**3.00**
horse-nettle (*Solanum carolinense*)	Facu	62.50	1.13
white clover (*Trifolium repens*)	**Facu**	**87.50**	**3.75**
			∑= **100.00**

[2] In 1999, *Juncus anthelatus* was elevated from a variety of *J. tenuis* to the species level. As a result it is not formally listed in Reed (1988) or on the USFWS 1996 revised list. Various region floras such as the Flora of North American Editorial Committee (2000) and Weakley (2011) indicate its preference for wet habitats. We concur and consider it a wetland indicator.

Table 2. Substrate/Herbaceous Species Frequency and Average Cover Percent, BCCX Wetland Enhancement Area, Pikeville, TN, September 2011.

Substrate/Herbs	Wetland Indicator Status	Percent Frequency	Average Percent Cover
Twig/Leaf Litter [3]	**---**	**91.67**	**4.42**
purple false foxglove (*Agalinis purpurea*)	Facw	8.33	0.25
small-flowered agrimony (*Agrimonia parviflora*)	Fac	8.33	0.42
redtop (*Agrostis gigantea*)	Facw	16.67	1.67
hog-peanut (*Amphicarpaea bracteata*)	Fac	8.33	0.42
devil's beggar-ticks (*Bidens frondosa*)	Facw	8.33	0.58
sallow sedge (*Carex lurida*)	Obl	8.33	0.17
fox sedge (*Carex vulpinoidea*)	Obl	25.00	1.25
mistflower (*Conoclinium coelestinum*)	Fac	16.67	0.50
tapered rosette grass (*Dichanthelium* acuminatum)	Fac	8.33	0.42
deer tongue grass (*Dichanthelium clandestinum*)	Facw	8.33	0.58
cypress witch grass (*Dichanthelium dichotomum*)	Fac	8.33	0.42
broom panic grass (*Dichanthelium scoparium*)	**Facw**	**16.67**	**2.92**
Virginia buttonweed (*Diodia virginiana*)	Facw	16.67	1.08
taper-tip rush (*Juncus acuminatus*)	Obl	8.33	0.17
greater poverty rush [4] (*Juncus anthelatus*)	Fac?	16.67	1.42
soft rush (*Juncus effusus*)	**Facw+**	**41.67**	**5.58**

[3] Bolded entries indicate dominant species or substrates (i.e. cover contributions exceed 2% and frequency values are greater than 10%).

[4] In 1999, *Juncus anthelatus* was elevated from a variety of *J. tenuis* to the species level. As a result it is not formally listed in Reed (1988) or on the USFWS 1996 revised list. Various region floras such as the Flora of North American Editorial Committee (2000) and Weakley (2011) indicate its preference for wet habitats. We concur and consider it a wetland indicator.

Table 2 Continued

Substrate/Herbs	Wetland Indicator Status	Percent Frequency	Average Percent Cover
rice cut grass (*Leersia oryzoides*)	Obl	8.33	0.83
beaked panic grass (*Panicum anceps*)	Fac-	8.33	1.67
redtop panic grass (*Panicum rigidulum*)	**Facw**	**91.67**	**51.33**
punctate smartweed (*Polygonum punctatum*)	Facw+	8.33	0.42
common cinquefoil (*Potentilla simplex*)	Facu	8.33	0.25
clustered mountainmint (*Pycnanthemum muticum*)	Fac	8.33	2.08
Maryland meadowbeauty (*Rhexia mariana*)	**Facw+**	**50.00**	**7.50**
brownish beaksedge (*Rhynchospora capitellata*)	Obl	8.33	0.17
swamp rose (*Rosa palustris*)	Obl	8.33	0.42
wool-grass (*Scirpus cyperinus*)	**Obl**	**25.00**	**8.92**
Georgia bulrush (*Scirpus georgianus*)	Obl	8.33	2.50
helmet flower (*Scutellaria integrifolia*)	Fac	16.67	0.75
horse-nettle (*Solanum carolinense*)	Facu	8.33	0.25
tall ironweed (*Vernonia gigantea*)	Fac+	16.67	0.67
			∑= **100.00**

Table 3. Average Density and Frequency of Planted (P) and Naturally-Invading Woody Seedlings, BCCX Wetland Creation Area, Pikeville, TN, September 2011.

Species	Wetland Indicator Status	Average Frequency (%)	Average Density (stems/acre)
red maple **(P)** (*Acer rubrum*)	Fac	100.00	35.00
common serviceberry **(P)** (*Amelanchier arborea*)	Facu	50.00	10.00
sweetgum **(P)** (*Liquidambar styraciflua*)	Fac+	50.00	15.00
yellow-poplar **(P)** (*Liriodendron tulipifera*)	Facu	25.00	5.00
			∑ = **65.00**

Table 4. Average Density and Frequency of Planted (P) and Naturally-Invading Woody Seedlings, BCCX Wetland Enhancement Area, Pikeville, TN, September 2011.

Species	Wetland Indicator Status	Average Frequency (%)	Average Density (stems/acre)
red maple **(P)** (*Acer rubrum*)	Fac	83.33	26.67
sweetgum **(P)** (*Liquidambar styraciflua*)	Fac+	66.67	26.67
blackgum **(P)** (*Nyssa sylvatica*)	Fac	16.67	6.67
Shumard oak **(P)** (*Quercus shumardii*)	Facw-	16.67	6.67
multiflora rose (*Rosa multiflora*)	Upl	16.67	3.33
swamp rose (*Rosa palustris*)	Obl	16.67	83.33
			∑ = **153.33**

Table 5. Average Density and Frequency of Planted (P) and Naturally-Invading Woody Seedlings, BCCX Upland Buffer Areas, Pikeville, TN, September 2011.

Species	Wetland Indicator Status	Average Frequency (%)	Average Density (stems/acre)
black cherry (*Prunus serotina*)	Facu	25.00	5.00
white oak **(P)** (*Quercus alba*)	Facu	100.00	77.50
red oak **(P)** (*Quercus rubra*)	Facu	100.00	122.50
			∑ = **205.00**

Table 6. Soil Profile Descriptions from the BCCX Wetland Creation Area, Pikeville, TN, September 2011.

Sample Location	Depth (Inches)	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/ Contrast	Texture, Structure, etc.
Plot C-1	0-2	10YR 5/4			sandy loam
	2-6	10YR 4/2	10YR 4/6	1%	sandy loam, compacted layer at 6 in.
	6-10	10YR 5/6	10YR 4/2 10YR 5/3	5% 10%	sandy loam
	10-20	10YR 6/4	10YR 5/8	30%	sandy clay loam
Plot C-2	0-1	10YR 5/4			sandy loam
	1-6	10YR 4/2	10YR 5/3	5%	sandy loam, compacted layer at 6 in.
	6-20	10YR 6/4	10YR 5/6	25%	sandy loam
Plot C-3	0-1	10YR 5/4			sandy loam
	1-10	10YR 4/2	2.5Y 6/4	1%	sandy loam
	10-20	2.5Y 6/3	10YR 5/8	25%	sandy loam, compacted layer at 10 in.
Plot C-4	0-6	10YR 4/3			silt loam
	6-20	2.5Y 6/6	10 YR 5/6	25%	sandy loam, compacted layer at 6 in.

Table 7. Occurrence of Planted (P) and Naturally-Invading Woody Species Within Riparian Zones. BCCX Stream Enhancement Area, Pikeville, TN, September 2011.

Unnamed Tributary to Bee Creek, Stream Segment 1

Species	Wetland Indicator Status	Average Number of Live Stems per 100 ft of Stream
red maple **(P in part)** (*Acer rubrum*)	Fac	1.0
stream alder **(P in part)** (*Alnus serrulata*)	Facw	31.6
black chokeberry **(P)** (*Aronia melanocarpa*)	Fac	0.2
buttonush **(P in part)** (*Cephalanthus occidentalis*)	Obl	3.2
silky dogwood **(P in part)** (*Cornus amomum*)	Facw+	7.4
black cherry (*Prunus serotina*)	Facu	0.2
white oak **(P)** (*Quercus alba*)	Facu	0.4
Shumard oak **(P)** (*Quercus shumardii*)	Facw-	1.8
multiflora rose (*Rosa multiflora*)	Upl	9.8
swamp rose (Rosa *palustris*)	Obl	10.6
black willow (*Salix nigra*)	Obl	20.8
elderberry **(P in part)** (*Sambucus canadensis*)	Facw-	5.4
hardhack (*Spiraea tomentosa*)	Facw	2.6
		∑ (P)= 51.0 [5]
		Grand ∑= 95.0

[5] Totals presented here are for those species which were included on the planting manifest. Because many of these same species occur naturally along the mitigated stream segment, it was frequently impossible to discern planted individuals from native ones.

Table 7 (continued)

Unnamed Tributary to Bee Creek, Stream Segment 4

Species	Wetland Indicator Status	Average Number of Live Stems per 100 ft of Stream
red maple **(P in part)** (*Acer rubrum*)	Fac	3.0
buttonush **(P in part)** (*Cephalanthus occidentalis*)	Obl	4.0
black cherry (*Prunus serotina*)	Facu	3.0
Shumard oak **(P in part)** (*Quercus shumardii*)	Facw-	1.0
swamp rose (Rosa *palustris*)	Obl	32.0
elderberry **(P in part)** (*Sambucus canadensis*)	Facw-	33.0
		∑ (P)= 41.0
		Grand ∑= 76.0

Site Photos

Wetland Creation and Enhancement
Photo Reference Points

Photo 1.

Creation Area, Photo Reference Point C2: North

Dominant Vegetation: common ragweed (Facu), three-seeded mercury (Fac-), yellow foxtail grass (Fac)

Comments: Wetland creation areas are strongly dominated by common ragweed which accounts for nearly 14% of herbaceous cover.

Photo 2.

Creation Area, Photo Reference Point C2: South

Dominant Vegetation: common ragweed (Facu), three-seeded mercury (Fac-), smooth paspalum (Facw-)

Comments: Soils within the creation area are low in organics and have been eroded in some locations. As a result, bare soils and other non-vegetated substrates currently occupy, on average, about 56% of the surface area.

Photo 3.

Creation Area, Photo Reference Point C2: East

Dominant Vegetation: common ragweed (Facu), three-seeded mercury (Fac-)

Comments: Weather extremes have also probably played a roll in slowing the establishment of herbs. After a wet winter and spring, combined rainfall for July and August totaled just over 2 inches.

Photo 4.

Creation Area, Photo Reference Point C2: West

Dominant Vegetation: : common ragweed (Facu), three-seeded mercury (Fac-)

Comments: Many portions of the creation area are underlain with a hard, compacted layer (fragipan). This physical obstruction slows the downward movement of water after precipitation events.

Photo 5.

Creation Area, Photo Reference Point C4: North

Dominant Vegetation: common ragweed (Facu), smooth crab grass (Upl)

Comments: Sparse vegetation in this part of the site is primarily the result of prolonged ponding of water. Saturated soils are visible at photo left.

Photo 6.

Creation Area, Photo Reference Point C4: South

Dominant Vegetation: common ragweed (Facu), greater poverty rush (Fac?), grass-leaved rush

Comments: Note the water-scoured soils in the right of this view. Drift lines composed of straw that had been used in effort to stabilize the site can also be seen in the foreground.

Photo 7.

Creation Area, Photo Reference Point C4: East

Dominant Vegetation: common ragweed (Facu), smooth crab grass (Upl)

Comments: Other evidence of surface hydrology includes soil cracking, especially in areas of silt accumulation.

Photo 8.

Creation Area, Photo Reference Point C4: West

Dominant Vegetation: common ragweed (Facu), greater poverty rush (Fac?), grass-leaved rush, yellow foxtail grass (Fac)

Comments: Again, debris dams and scouring provide evidence of periodically active surface flows.

Photo 9.

Enhancement Area, Photo Reference Point E1: North

Dominant Vegetation: redtop panic grass (Facw), broom panic grass (Facw), clustered mountainmint (Fac), Maryland meadowbeauty (Facw+)

Comments: Dense stands of native grasses and forbs were found throughout each of the enhancement areas.

Photo 10.

Enhancement Area, Photo Reference Point E1: South

Dominant Vegetation: redtop panic grass (Facw), tall ironweed (Fac+)

Comments: Presumably because of the density of these wetland species, planted tree seedlings had difficulty competing. Survivorship averaged only 67 stems/ac.

Photo 11.

Enhancement Area, Photo Reference Point E1: East

Dominant Vegetation: redtop panic grass (Facw), clustered mountainmint (Fac), cypress witch grass (Fac), boneset (Facw+)

Comments: Residual wetland shrubs contributed considerably to woody plant densities. Swamp rose alone was found to occur at the average rate of 83 stems/ac.

Photo 12.

Enhancement Area, Photo Reference Point E1: West

Dominant Vegetation: redtop panic grass (Facw), clustered mountainmint (Fac), cypress witch grass (Fac), Maryland meadowbeauty (Facw+)

Comments: Most soils in enhancement areas were moist at the time of the field survey but not saturated.

Photo 13.

Enhancement Area, Photo Reference Point E3: North

Dominant Vegetation: redtop panic grass (Facw), broom panic grass (Facw), clustered mountainmint (Fac), Maryland meadowbeauty (Facw+)

Comments: Dense stands of native grasses and forbs were found throughout each of the enhancement areas.

Photo 14.

Enhancement Area, Photo Reference Point E3: South

Dominant Vegetation: redtop panic grass (Facw), tall ironweed (Fac+)

Comments: Presumably because of the density of these wetland species, planted tree seedlings had difficulty competing. Survivorship averaged only 67 stems/ac across all enhancement areas.

Photo 15.

Enhancement Area, Photo Reference Point E3: East

Dominant Vegetation: redtop panic grass (Facw), clustered mountainmint (Fac), cypress witch grass (Fac), boneset (Facw+)

Comments: Residual wetland shrubs contributed considerably to woody plant densities. Swamp rose alone was found to occur at the average rate of 83 stems/ac.

Photo 16.

Enhancement Area, Photo Reference Point E3: West

Dominant Vegetation: redtop panic grass (Facw), clustered mountainmint (Fac), cypress witch grass (Fac), Maryland meadowbeauty (Facw+)

Comments: Actual densities may prove to be somewhat higher than reported since small seedlings were very difficult to find in the thick cover of herbs and grasses.

Photo 21. **Upland Buffer Zones:** Twenty-five ft-wide buffers, external to riparian buffers, were planted with upland oak species in order to provide extra protection to the restored streams. Areas were first mown to make planting easier. Current oak survivorship averages about 200 stems/ac. A portion of Stream 1 lies in the center left of the photo.

Photo 22. **Gooseberry Transplant Area:** Nineteen rare granite gooseberry shrubs, rescued from the prison construction site, and transplanted to the mitigation area in 2009, have survived and appear to be thriving. Total shrub cover is about 1,990 ft^2.

Stream Enhancement
Photo Reference Points

(Photo-reference points were taken at the start of each 200 ft-long monitoring plot looking downstream)

Photo 23.

Stream 1 Enhancement Area, Photo Reference Point 1:

Dominant Vegetation: redtop panic grass (Facw), wool-grass (Obl), Maryland meadowbeauty (Facw+)

Comments: Planted stream alder, buttonbush, and black chokeberry were found scattered at this location.

Photo 24.

Stream 1 Enhancement Area, Photo Reference Point 2:

Dominant Vegetation: redtop panic grass (Facw), soft rush (Facw+), elderberry (Facw-)

Comments: One of the site's planted elderberries is visible here.

Photo 25.

Stream 1 Enhancement Area, Photo Reference Point 3:

Dominant Vegetation: deer tongue grass (Facw), late-flowering thoroughwort (Fac), silky dogwood (Facw+).

Comments: As was often the case, this site contained both planted and naturally-occurring silky dogwood. Distinguishing between the two was not always possible in some areas.

Photo 26.

Stream 1 Enhancement Area, Photo Reference Point 4:

Dominant Vegetation: silky dogwood (Facw+), deer tongue grass (Facw)

Comments: In other areas residual silky dogwood were more easily determined.

Photo 27.

Stream 1 Enhancement Area, Photo Reference Point 5:

Dominant Vegetation: rice cut grass (Obl), small-flowered agrimony (Fac), silky dogwood (Facw+), black willow (Obl)

Comments: The downstream end of Stream Segment 1 contained more mature residual tree species such as the black willow in the distance.

Photo 28.

Stream 2 Enhancement Area, Photo Reference Point 1:

Dominant Vegetation: rice cut grass (Obl), soft rush (Facw+), Georgia bulrush (Obl), winged sumac (Facu-)

Comments: At 135 stems/100 ft of stream, Stream Segment 2 supported the highest density of planted and naturally invasive woody species. The plunge pool in the foreground lies just downstream of two culverts which pass beneath SR 301. It gives a much exaggerated impression of the size of the waterway.

Photo 29.

Stream 1 Enhancement Area 3 , Photo Reference Point 1:

Dominant Vegetation: rice cut grass (Obl), soft rush (Facw+)

Comments: By contrast, Stream Segment 3 had the lowest density at just 16 stems/100 ft. Again, the plunge pool gives a false impression about the size of the waterway.

Photo 30.

Stream 1 Enhancement Area 4, Photo Reference Point 1:

Dominant Vegetation: soft rush (Facw+), fireweed (Fac-), small-flowered agrimony (Fac), Pennsylvania smartweed (Facw)

Comments: Stream 4 was relegated to scattered pools at the time of the survey. It averaged 76 stems/100 ft of stream length. Most common were planted elderberry and naturally-occurring swamp rose. These were concentrated in the downstream portion.

Photo Supplement

Photo 31.

Photo Supplement, Prison Construction:

Comments: Construction of the prison expansion complex continues with completion scheduled for November 2012.

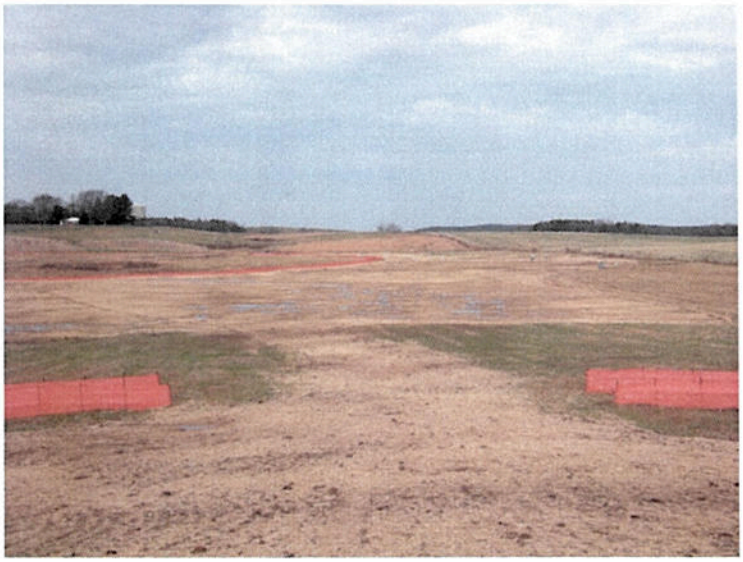


Photo 32.

Photo Supplement, Wetland Creation:

Comments: Grading of the wetland creation area was completed in October 2010. Unfortunately, even though the site was seeded with stabilizing grasses and mulched, it took place too late in the season for germination to take place. This view is looking north from the soil disposal area.

Photo 33.

Photo Supplement, Wetland Creation:

Comments: Shortly after grading was completed the creation site was planted with tree seedlings typical of a Cumberland Seepage Forest, the targeted wetland type. Planting rates were 435 trees/ac.

Photo 34.

Photo Supplement, Wetland Enhancement

Comments: Wetland enhancement involved planting tree seedlings in degraded seepage wetlands that had been occasionally grazed by cattle or cut over for hay. Like the created wetland, these areas are to be protected in perpetuity from activities that are incompatible with full wetland functioning, including agriculture. Because the native grasses were so dense, they had to be mown first to facilitate tree planting.

Photo 35.

Photo Supplement, Wetland Creation:

Comments: This spreader pond was installed in an effort to more evenly distribute water entering the site from the north into the various parts of the mitigation area. Extremely heavy rains, particularly in March 2011, overwhelmed the structure and caused flooding of the wetland creation site.

Photo 36.

Photo Supplement, Wetland Creation:

Comments: This produced a cascading effect which then blew out this down-gradient spreader berm. The berm has since been repaired.

Photo 37.

Photo Supplement, Wetland Creation:

Comments: Numerous erosion channels formed and stripped some of the A-soil horizons. Note the straw mulch which proved ineffectual in preventing scouring. During the growing season the most prominent channels were blocked by installing coir logs to slow water flow and discourage further down-cutting. Establishment of an herb cover will be critical to the future stability of this area. Tree seedlings will also have to be replanted.

Photo 38.

Photo Supplement, Wetland Enhancement

Comments: By contrast, wetland enhancement areas which were also flooded, sustained very little erosion damage since they contained established plant cover.

Section 4

Site Maps

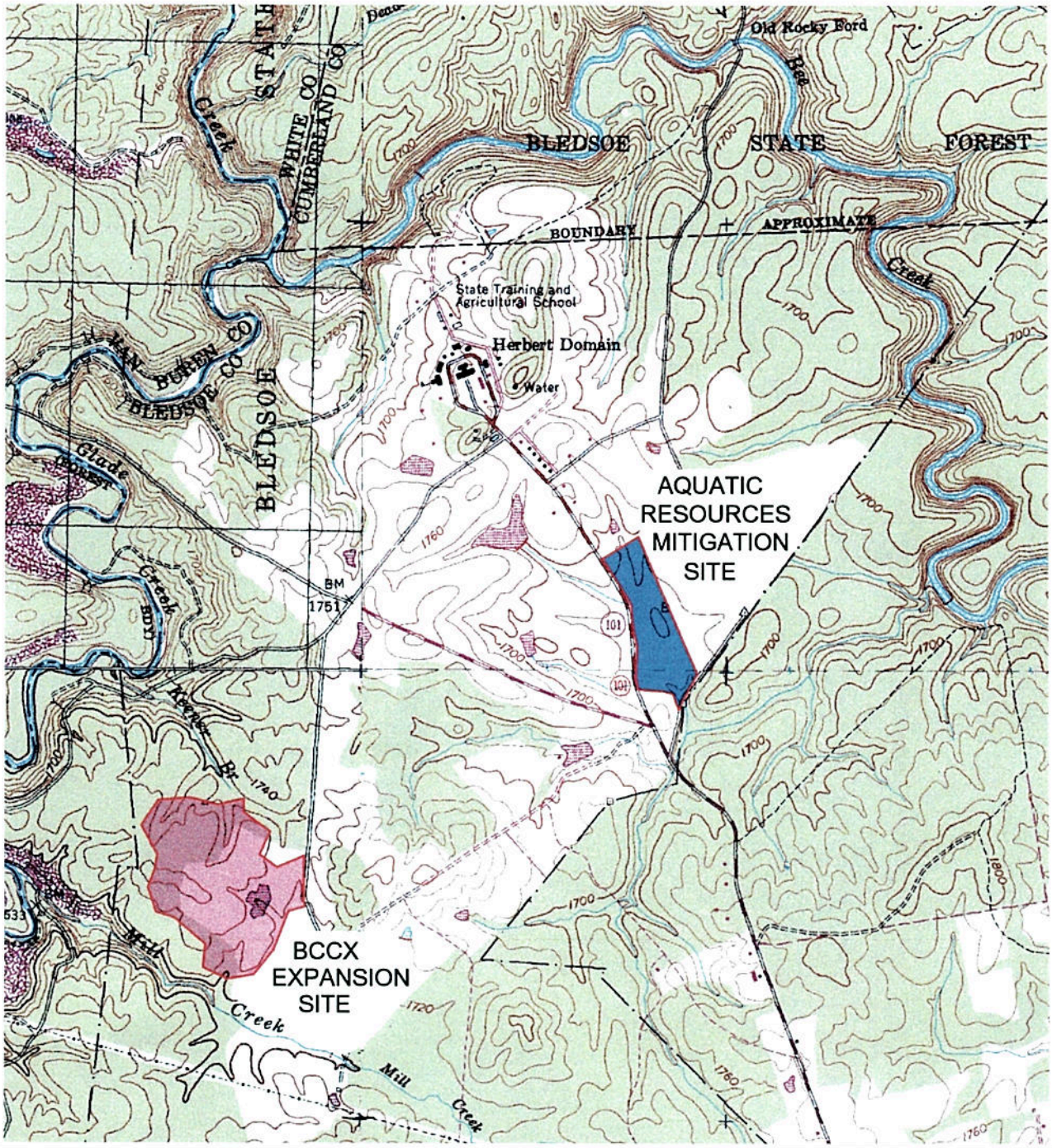
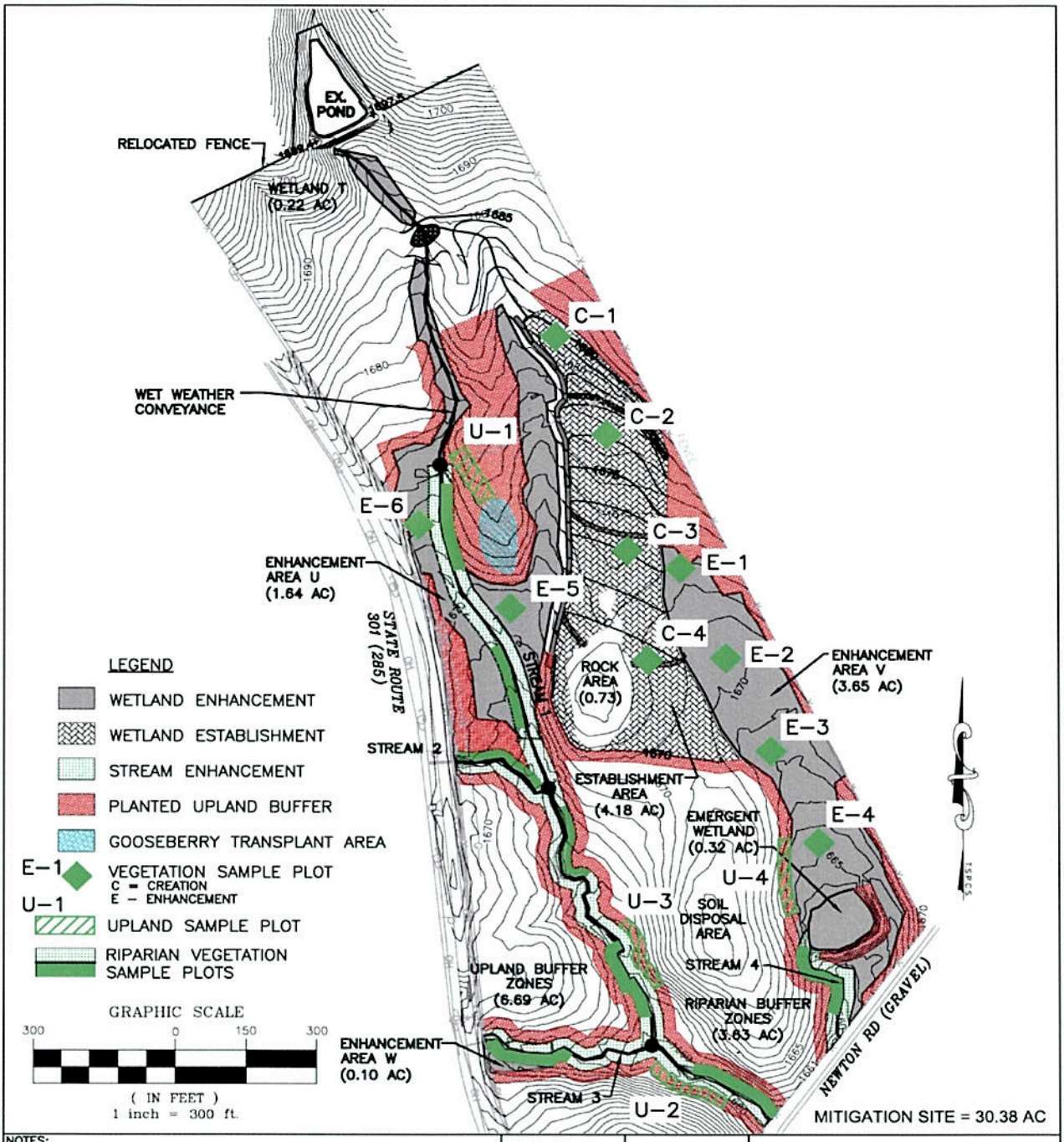


Figure 1. Location Map
DeLorme 3-D TopoQuads™
Herbert Domain (1981), Billingsley Gap (1981), Sampson (1974), Lonewood (1983), Tennessee

SCALE 1 : 24,000

2,000 1,500 1,000 500 0 FT. 2,000

N



NOTES:

DESIGNED BY:	KJK
CHECKED BY:	HSH
CADQA BY:	DEH
DRAWN BY:	DEH
SCALE:	1" = 300'
DATE:	10-07-11
REVISION NO.:	1

BLEDSOE COUNTY CORRECTIONAL COMPLEX
MITIGATION SITE
BEE CREEK MILE 11.4 RIGHT BANK
BLEDSOE COUNTY, PIKEVILLE, TENNESSEE
APPLICANT: TDF&A, (USACE FILE NO. 2005-02425)

FIGURE 2:
STREAM AND WETLAND MONITORING MAP

PROJECT NO.: 142.013.09
FILENAME: WM-1.DWG

Quantum Environmental & Engineering Services, LLC
126 Dante Road
Knoxville, TN 37918
PHONE (865) 689-1395, FAX (865) 689-6844

Section 5

Conclusions

Wetland Mitigation

Summary Statement: First year monitoring efforts indicate that the wetland mitigation at the Bledsoe County Correctional Complex has met its performance standards for hydrology but has failed to meet its performance standards and principle mitigation goals for soils and planted woody vegetation. Construction of the wetland creation area late in the 2010 season resulted in the inability to establish a healthy cover of annual grasses. As a consequence, heavy rains which occurred soon afterward, and then carried on into the late winter, produced widespread scouring and erosion in upper soil horizons. The volume of inflow to the site was greater than anticipated, and was therefore also a contributing factor. These excesses of hydrology, coupled with very dry mid-summer weather resulted in unacceptably high mortality rates for planted woody seedlings. Somewhat unexpectedly, seedling mortality in enhancement areas was also rather high. Prolonged soils saturation in the winter and competition from dense stands of native wetland grasses are possible reasons for poor survival.

Immediate corrective actions should involve diverting as much of the water as possible that is entering the site from the north, into the western enhancement area. This should be done to lessen flow through the creation area until a sufficient erosion-resistance herb layer can be established. Survey results show that the creation area presently contains about 44% invasive plant cover. This is encouraging, but supplemental seeding of annual grasses should be considered early next spring. Even though weather can never be controlled, a second effort should be made to replant both the creation and enhancement areas in the fall of 2011 before soils freeze. If conditions allow, judicious mowing in enhancement zones should be undertaken to facilitate the planting of seedlings. This will also allow the seedlings to better compete with grasses for light when they break dormancy and begin to grow in the spring. Additionally, a limited number of balled and burlap trees of about 6 ft (1-2 in. caliper) could be inter-planted with the seedlings.

The permittee's commitment to protect the site in perpetuity via deed restriction has yet to be fulfilled. Neither has the requirement to install signage designating the mitigation site as a protected property. Both of these should be accomplished as soon as possible even though there are no immediate threats to the property.

Stream Mitigation

Summary Statement: Principal performance goals for the onsite stream segments are to maintain stable, non-eroding embankments through the wetland mitigation construction period and to establish sustainable vegetated riparian and upland buffers for long term protection. All streams were found to be largely un-impacted by construction and appeared stable. Performance standards for planted riparian vegetation however had not been met because of high seedling mortality. Some of this was being offset by the rapid growth of native tree and shrub species which were conspicuous in a few locations. Upland oak buffers, which had no performance standards associated with them, fared somewhat better, although mortality was high in areas prone to drought stress.

As with the wetland mitigation areas, replanting of streamside shrubs will be necessary to attain performance standards. Planting selections should concentrate on avoiding species that surveys have shown to be well established on certain stream reaches (e.g. silky dogwood on Stream 2). As mentioned above, planting should occur in the late fall 2011 before soils freeze. Mowing in limited areas would help with the planting effort if site conditions permit.

Appendix A
Pre-Construction Stream Segment Habitat Assessments

Unnamed Tributaries to Bee Creek:

Stream 1 (first and second order)

Stream 2 (first order)

Stream 3 (first order)

Stream 4 (first order)

Division of Water Pollution Control
QSSOP for Macroinvertebrate Stream Surveys
Revision 4
Effective Date: October 2006

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Stream Segment 1	LOCATION BCCX Mitigation Site
STATION # Upper	ECOREGION 68a
LAT 35.75308 LONG -85.23763	WATERSHED GROUP
WBID/HUC 05130108	INVESTIGATORS P.C. Durr
FORM COMPLETED BY P.C. Durr	DATE 10/1/08TIME 11:30 A AM PM

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 76% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is<0.3m/s deep is >0.5m)	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)	Dominated by 1 velocity/depth regime (usually slow-deep)
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low – gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills> 75% of the available channel; or 25 % of channel substrate is exposed.	Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (BACK)

Station ID Stream Segment 1 Date 10/1/08

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5-7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >35.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods	Unstable; many eroded area; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE____(LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protective (score each bank) Note: determine left or right side by facing downstream	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE____(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE____(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0

TOTAL SCORE 115

Division of Water Pollution Control
QSSOP for Macroinvertebrate Stream Surveys
Revision 4
Effective Date: October 2006

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Stream Segment 2	LOCATION BCCX Mitigation Site
STATION # Upper	ECOREGION 68a
LAT 35.75136 LONG -85.23755	WATERSHED GROUP
WBID/HUC 05130108	INVESTIGATORS P.C. Durr
FORM COMPLETED BY P.C. Durr, Water Resources LLC	DATE 10/1/08 TIME 10:00 AAM PM

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **(6)**	5 4 3 2 1
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 76% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	**(5)** 4 3 2 1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is<0.3m/s deep is >0.5m)	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)	Dominated by 1 velocity/depth regime (usually slow-deep)
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **(6)**	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low – gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	**(10)** 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills> 75% of the available channel; or 25 % of channel substrate is exposed.	Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	**(5)** 4 3 2 1

Division of Water Pollution Control
QSSOP for Macroinvertebrate Stream Surveys
Revision 4
Effective Date: October 2006

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (BACK)

Station ID Stream Segment 2 Date 10/1/08

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5-7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >35.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods	Unstable; many eroded area; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE___(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protective (score each bank) Note: determine left or right side by facing downstream	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE___(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE___(LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0

TOTAL SCORE 86

Division of Water Pollution Control
QSSOP for Macroinvertebrate Stream Surveys
Revision 4
Effective Date: October 2006

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Stream Segment 3	LOCATION BCCX Mitigation Site
STATION # Upper	ECOREGION 68a
LAT 35.74961 LONG -85.23737	WATERSHED GROUP
WBID/HUC 05130108	INVESTIGATORS P.C. Durr
FORM COMPLETED BY P.C. Durr, Water Resources LLC	DATE 10/1/08 TIME 10:30A AM PM

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 76% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is<0.3m/s deep is >0.5m)	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)	Dominated by 1 velocity/depth regime (usually slow-deep)
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low – gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills> 75% of the available channel; or 25 % of channel substrate is exposed.	Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (BACK)

Station ID Stream Segment 3 Date 10/1/08

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5-7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >35.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods	Unstable; many eroded area; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE___(LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protective (score each bank) Note: determine left or right side by facing downstream	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE___(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE___(LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0

TOTAL SCORE 93

Division of Water Pollution Control
QSSOP for Macroinvertebrate Stream Surveys
Revision 4
Effective Date: October 2006

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Stream Segment 4	LOCATION BCCX Mitigation Site
STATION # Upper	ECOREGION 68a
LAT 35.75020 LONG -85.23505	WATERSHED GROUP
WBID/HUC 05130108	INVESTIGATORS P.C. Durr
FORM COMPLETED BY P.C. Durr, Water Resources LLC	DATE 10/1/08 TIME 11:00 AM PM

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 76% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is<0.3m/s deep is >0.5m)	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)	Dominated by 1 velocity/depth regime (usually slow-deep)
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low – gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills> 75% of the available channel; or 25 % of channel substrate is exposed.	Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1

Division of Water Pollution Control
QSSOP for Macroinvertebrate Stream Surveys
Revision 4
Effective Date: October 2006

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (BACK)

Station ID Stream Segment 4 Date 10/1/08

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5-7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >35.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods	Unstable; many eroded area; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE___(LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protective (score each bank) Note: determine left or right side by facing downstream	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE___(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE___(LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE___(RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0

TOTAL SCORE 91